

**OROVILLE FERC RELICENSING
(PROJECT No. 2100)**


**INTERIM REPORT
SP-F3.2 TASK 2
SP-F21 TASK 1**

**APPENDIX A
MATRIX OF LIFE HISTORY AND HABITAT REQUIREMENTS FOR
FEATHER RIVER FISH SPECIES**

**LITERATURE REVIEW OF LIFE HISTORY AND
HABITAT REQUIREMENTS FOR
FEATHER RIVER FISH SPECIES**

TULE PERCH

JANUARY 2003

Element	Element Descriptor	General	Feather River Specific
General			
common name (s)	English name (usually used by fishers and laypeople).	Tule Perch	
scientific name (s)	Latin name (referenced in scientific publications).	<i>Hysterocarpus traski</i>	
taxonomy (family)	Common name of the family to which they belong. Also indicate scientific family name.	Surfperches - <i>Embiotocidae</i> There are three subspecies, including Russian River Tule Perch, Clear Lake Tule Perch, and Sacramento Tule Perch (Moyle 2002).	
depiction	Illustration, drawing or photograph.		
range	Broad geographic distribution, specifying California distribution, as available.	<p>Tule perch are native to North America, including Clear Lake, the Russian River, the Sacramento-San Joaquin river system, and the Parajo Salinas River drainages (Torres 2002).</p> <p>Tule perch are native to most lowland rivers and creeks in the Central Valley, larger tributaries to the San Francisco estuary, Petaluma River, Coyote Creek, the San Joaquin River drainage, the Delta, Suisun Marsh, Napa River, Sonoma Creek, Alameda Creek, and Silverwood and Pyramid reservoirs (Moyle 2002).</p>	

Element	Element Descriptor	General	Feather River Specific
		Tule perch are found in the Sacramento River system, Clear Lake, upper Blue Lake, and the Russian River. Tule perch are apparently extirpated from the Pajaro, Salinas, and San Joaquin rivers (Wang 1986).	
native or introduced	If introduced, indicate timing, location, and methods.	Tule perch are native to California.	
ESA listing status	Following the categories according to California Code of Regulations and the Federal Register, indicate whether: SE = State-listed Endangered; ST =State-listed Threatened; FE = Federally listed Endangered; FT = Federally-listed Threatened; SCE = State Candidate (Endangered); SCT = State candidate (Threatened); FPE = Federally proposed (Endangered); FPT = Federally proposed (Threatened); FPD = Federally proposed (Delisting); the date of listing; or N = not listed.	Tule perch are not listed.	
species status	If native, whether: Extinct/extirpated; Threatened or Endangered; Special concern; Watch list; Stable or increasing. If introduced, whether: Extirpated (failed introduction); highly localized; Localized; Widespread and stable; Widespread and expanding.	As a species, the status of tule perch is “stable or increasing.” The Sacramento tule perch retains “watch list” status, the Clear Lake tule perch retains “watch list” status, and the Russian River tule perch retains “special concern” status (Moyle 2002).	
economic or recreational value	Indicate whether target species sought for food or trophy. Whether desirable by recreational fishers, commercial fishers, or both.		

Element	Element Descriptor	General	Feather River Specific
warmwater or coldwater	Warmwater if suitable temperature range is similar to basses; coldwater if suitable temperature range is similar to salmonids.		
pelagic or littoral	Environment: Pelagic - living far from shore; Littoral - living near the shore.		
bottom or water column distribution	Environment: bottom (benthic) or along water column.		
lentic or lotic	Environment: Lentic - pertaining to stagnant water, or lake-like; Lotic - moving water, or river-like.	Tule perch inhabit lotic environments (Moyle 2002).	
Adults			
life span	Approximate maximum age obtained.	Tule perch live an average of 5 years; few live to 7 to 8 years. In the Russian River, few tule perch live past 2 years (Moyle 2002).	
adult length	Indicate: Length at which they first reproduce; average length and maximum length the fish can attain.	The maximum size of tule perch is 5.9 inches (15.0 centimeters) in length (Torres 2002). The largest Tule perch on record is 8.7 inches (22 centimeters) Most tule perch are under 6.3 inches (16 centimeters) in length (Moyle 2002).	
adult weight	Indicate: Weight at which they first reproduce; average weight and maximum weight the fish can attain.		
physical morphology	General shape of the fish: elongated, fusiform, laterally compressed, etc.	Tule perch are deep bodied (Moyle 2002).	
coloration	Indicate color, and color changes, if any, during reproduction phase.	The coloring of tule perch is variable, but the back is generally dark, often bluish or purplish, and the belly color ranges from white to yellow, and the sides are either unbarred, narrow barred, or broad barred (Moyle 2002).	

Element	Element Descriptor	General	Feather River Specific
other physical adult descriptors	Unique physical features for easy identification.	Tule perch have small terminal mouths (Moyle 2002).	
adult food base	Indicate primary diet components.	Tule perch eat small invertebrates associated with aquatic plants, small amphipods, and benthic prey, such as midge larvae, small clams, brachyuran crabs, mysid shrimp, chironomid midges, baetid and ephemereid mayflies, and other aquatic insects (Moyle 2002).	
adult feeding habits	Indicate whether plankton eater, algae eater, bottom feeder, piscivorous, active hunter, ambush predator, filter feeder. Night, day, dusk or dawn feeder.	Tule perch are bottom feeders, and in some areas such as Clear Lake, they are midwater feeders (Moyle 2002).	
adult in-ocean residence time	For anadromous species, age when they migrate to the ocean and duration spent in the ocean before returning to freshwater to spawn.	N/A	
adult habitat characteristics in-ocean	For anadromous species, description of the ocean habitat utilized: whether along major current systems, gyres, pelagic (beyond continental shelves) and neritic (above continental shelves) zones, etc.	N/A	
Adult upstream migration (immigration)			
range of adult upstream migration timing	Time of year adults migrate upstream. If applicable, indicate for various runs.	N/A	
peak adult upstream migration timing	Time of year most adults migrate upstream. If applicable, indicate for various runs.	N/A	
adult upstream migration water temperature tolerance	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	N/A	

Element	Element Descriptor	General	Feather River Specific
adult upstream migration water temperature preference	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental.	N/A	
Adult holding (freshwater residence)			
water temperature tolerance for holding adults	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	Tule perch are not found in water temperatures greater than 77°F (25°C) (Moyle 2002).	
water temperature preference for holding adults	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental.	Tule perch generally prefer water temperatures lower than 71.6°F (22°C) (Moyle 2002).	
water depth range for holding adults	Reported range of observed (minimum and maximum) water depth utilization.	In Deer Creek, tule perch use pools and runs 1.6 to 3.3 feet (0.5 to 1 meter) deep (Moyle 2002).	
water depth preference for holding adults	Reported range of most frequently observed water depth utilization.		
substrate preference for holding adults	If bottom dwellers, indicate substrate: mud, sand, gravel, boulders, aquatic plant beds, etc. If gravel, indicate range or average size of gravel.	Tule perch prefer mud- to gravel-bottomed pools and runs of small to large, low elevation rivers and lakes, usually near emergent plants or overhanging banks (Torres 2002). Tule perch prefer beds of emergent aquatic plants, deep pools, and banks with complex cover, such as overhanging bushes, fallen trees, undercut banks, and riprap, and forage close to the bottom (Moyle 2002).	
water velocity range for holding adults	Reported range of observed (minimum and maximum) water velocity utilization.	Tule perch forage close to the bottom where water velocities range from 0.03 to 0.46 feet per second (1 to 14 centimeters per second) (Moyle 2002).	
water velocity preference for holding adults	Reported range of most frequently observed water velocity utilization.		

Element	Element Descriptor	General	Feather River Specific
other habitat characteristics for holding adults	General description of habitat (e.g. turbid or clear waters, lentic or lotic, presence of aquatic plant beds, debris, cover, etc.).	Pregnant tule perch females are concealed in slower moving areas or backwaters with beds of aquatic plants or with dense cover created by tree branches (Moyle 2002).	
timing range for adult holding	Time of year (earliest-latest) and duration of stay from upstream migration to spawning.	N/A	
timing peak for adult holding	Time of year when maximum number of adults are present before spawning.		
Spawning			
fecundity	Average or range in the number of eggs females lay in a spawning season.	<p>The number of tule perch embryos is typically 22 to 83, 5 to 93, and 26 to 75 (Wang 1986).</p> <p>The number of young produced by each tule perch female increases with size and varies among subspecies. In the Russian River, 12 to 45 young are produced by a 2.8 to 3.1 inch (70-80 millimeter) female and 42 young are produced by a 3.9 inch (100 millimeter) female. In Clear Lake, 25 to 60 young are produced, and in the San Francisco estuary, 33 to 60 young are produced (Moyle 2002).</p>	
nest construction	Location and general description of nest -- substrates, aquatic plants, excavations, crevices, habitat types, etc.		
nest size	Size and average dimensions of the nest.		
spawning process	Indicate whether nest builder, broadcast spawner, or other.	<p>After mating, tule perch sperm are stored in the ovary until the ova become mature, fertilization occurs in January (eggs or early embryos were observed in the ovarian cavity in January), and birth occurs in May (Wang 1986).</p> <p>Male tule perch court females in late summer. Each female mates multiple times, fertilization of eggs occurs in January, stored sperm is typically from several males, and births are live, mostly tail first</p>	

Element	Element Descriptor	General	Feather River Specific
		(Moyle 2002).	
spawning substrate size/characteristics	Range of substrates used during spawning (e.g. mud, sand, gravel, boulders, beds of aquatic plants). Indicate presence of plant/wood debris, crevices at spawning sites. If gravel, indicate range of average size.	Tule perch spawn among tule marshes and other type of vegetation (Wang 1986).	
preferred spawning substrate	Indicate preferred spawning substrate (e.g. mud, sand, gravel, boulders, plant bed, etc).		
water temperature tolerance for spawning	Range of water temperatures allowing survival. Indicate stressful or lethal levels.		
water temperature preference for spawning	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.		
water velocity range for spawning	Minimum and maximum speed of water current the spawning fish can tolerate.		
water velocity preference for spawning	Preferred water current (flow velocity) during spawning.		
water depth range for spawning	Reported range of observed (minimum and maximum) water depth utilization.		
water depth preference for spawning	Reported range of most frequently observed water depth utilization.		
range for spawning timing	Earliest and latest time of season or year in which spawning occurs.	Tule perch mating occurs in July through September (Wang 1986). Tule perch mating occurs from July through September (Moyle 2002).	

Element	Element Descriptor	General	Feather River Specific
peak spawning timing	Time of year most fish start to spawn.		
spawning frequency (iteroparous/semelparous)	Semelparous - producing all offspring at one time, such as in most salmon. Usually these fish die after reproduction. Iteroparous - producing offspring in successive, e.g., annual or seasonal batches, as is the case in most fishes.		
Incubation/early development			
egg characteristics	Shape, size, color, in clusters or individuals, stickiness, and other physical attributes.	N/A	
water temperature tolerance for incubation	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	Tule perch give birth at water temperatures ranging from 64.4°F to 68°F (18°C to 20°C) (Wang 1986).	
water temperature preference for incubation	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.	N/A	
time required for incubation	Time duration from fertilization to hatching. Note: Indicate at which temperature range. Incubation time is temperature-dependent.		
size of newly hatched larvae	Average size of newly hatched larvae.	Early developed tule perch embryos are 0.01 inches (0.25 millimeters) in January, and 0.12 inches (3.0 millimeters) in March. At birth, tule perch range between 1.3 and 1.7 inches (33 to 44 millimeters) in length (Wang 1986).	
time newly hatched larvae remain in gravel	Time of year of hatching, and duration between hatching and emergence from gravel.	N/A	
other characteristics of larvae	Alevin -- early life history phase just after hatching (larva) when yolk-sac still present.		

Element	Element Descriptor	General	Feather River Specific
timing range for emergence	Time of year (earliest-latest) hatchlings (larvae and alevins) leave or emerge from the nesting/hatching (gravel) sites.	N/A	
timing peak for emergence	Time of year most hatchlings emerge.	Tule perch are born in May (Wang 1986). Tule perch are born in May or June (Moyle 2002).	
size at emergence from gravel	Average size of hatchlings at time of emergence.	N/A	
Juvenile rearing			
general rearing habitat and strategies	General description of freshwater environment and rearing behavior.		
water temperature tolerance for juvenile rearing	Range of water temperatures allowing survival. Indicate stressful or lethal levels.		
water temperature preference for juvenile rearing	Range of suitable, preferred, or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.		
water velocity ranges for rearing juveniles	Reported range of observed (minimum and maximum) water velocity utilization.		
water velocities preferred by rearing juveniles	Reported range of most frequently observed water velocity utilization.		
water depth range for juvenile rearing	Reported range of observed (minimum and maximum) water depth utilization.		

Element	Element Descriptor	General	Feather River Specific
water depth preference for juvenile rearing	Reported range of most frequently observed water depth utilization.		
cover preferences for rearing juveniles	Type of cover for protection from predators used by rearing juveniles (e.g. crevices, submerged aquatic vegetation, overhanging vegetation, substrate cover, undercover bank, small woody debris, large woody debris).		
food base of juveniles	Indicate primary diet components. Also indicate the diet changes, if any, as growth occurs.		
feeding habits of rearing juveniles	Indicate whether plankton eater, algae eater, bottom feeder, piscivorous, active hunter, ambush predator, filter feeder. Night, day, dusk or dawn feeder. Also indicate change of feeding habits growth occurs.		
predation of juveniles	Indicate which species prey on juveniles.		
timing range for juvenile rearing	Range of time of year (months) during which rearing occurs.		
timing peak for juvenile rearing	Time of year (months) during which most rearing occurs.		
Juvenile emigration			
time spent in fresh water prior to emigrating	Duration (in years and/or months) from emergence to emigration to the ocean.	N/A	

Element	Element Descriptor	General	Feather River Specific
water temperature tolerances during emigration	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	N/A	
water temperature preferences during emigration	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.	N/A	
emigration timing range	Time of year juveniles commence emigration and duration of emigration.	N/A	
emigration timing peak	Time of year most juveniles are emigrating.	N/A	
size range of juveniles during emigration	Minimum and maximum sizes (inches or mm) of emigrating juveniles. Indicate average size.	N/A	
factors associated with emigration	Pulse flows, water temperature changes, turbidity levels, photoperiod, etc.	N/A	
Other potential factors			
DO	Levels of dissolved oxygen in water expressed in mg/l tolerated by fish.	Tule perch require cool, well oxygenated water (Moyle 2002).	
pH	Alkalinity/acidity of water (expressed in pH) that fish can tolerate.		
turbidity	Indicate turbidity or state of water (e.g., clear water or presence of siltation or organic/inorganic matter in water) that fish can tolerate.	Tule perch require low turbidity (Moyle 2002).	
factors contributing to mortality	e.g. fishing/angling mortality, drastic habitat alterations, unfavorable climatic changes, etc.	Mortality of tule perch is caused by poor water quality, toxic chemicals, and loss of habitat (Moyle 2002).	

References

- Moyle, P. B. 2002. Inland Fishes of California. Berkeley: University of California Press.
- Torres, A. G. Species Summary *Hysterocarpus traski* Tule Perch. Available at www.fishbase.org
- Wang, J. 1986. Interagency Ecological Program Technical Report #9. January 1986. Fishes of the Sacramento-San Joaquin Estuary and Adjacent Waters, California: A Guide to the Early Life Histories. Tule Perch - *Hysterocarpus traski*.